Exhibit IV

IP VPN SLA Project Achievement

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IP VPN-Aware Correlator

Applied Research invented an algorithm and prototyped the corresponding SLA monitoring system for monitoring and collecting SLA statistical metrics. The proposed mechanism advances the class of SLA monitoring technology that is based on passive monitoring techniques. With the new algorithm, end-points of an IP VPN can be automatically identified and the SLA statistics among these VPN end-points can be computed in a non-intrusive and accurate manner. Unlike traditional data collection methods, our proposed algorithm allows the collection of SLA parmeters in a close to "real-time" fashion (in the order of seconds). Moreover, the IP-aware mechanism can be applied to various technologies including IP, ATM, Frame Relay, and enterprise networks in a scalable architecture. Many of these features are not currently available in commercial products.

The IP-Aware Correlation Algorithm

The IP-Aware Correlation Algorithm (IPACA) works by correlating the inherently error-prone, out-of-order IP packet-traces among multiple measuring points of an VPN in an ATM/FR/IP network. The algorithm works with one direction of traffic flow—a similar mechanism may be applied to synchronize traces in the opposite direction, using the same measuring points. IPACA utilizes passive monitors at two measuring choke-points at each end of the network; it can use any passive monitoring hardware that is able to capture all IP headers flowing through the high bandwidth data-pipes at measuring points A and B. The invention consists of two distinctive parts: 1) VPN end-point identification, and 2) Correlation of IP VPN. The VPN identification allows automatic configuration of the IP-aware monitors. It includes a mechanism for the IP-aware correlator to "learn" who are using the IP-VPN. This VPN identification mechanism is especially useful in a dynamic scenario where there are churns of VPN configurations. Once the IP-VPN end-points are known, the IP-VPN-aware correlator operates by creating a unique IP framing structure at the sender side. Information regarding a particular VPN such as the IP frame pattern, IP packet counts, and timing information is then collected and sent to the receiver side via a low-bandwidth control channel. At the receiver side, an efficient algorithm is used to correlate the IP VPN frames between the sender and receiver. Once the IP VPN frames are synchronized, various SLA parameters including packet loss, throughput, availability, delay, and jitter, can be computed accurately.

The passive monitors at the measuring points are attached to (possibly auxiliary) computers that implement the IP-VPN-aware correlation algorithm. IPACA can be easily scaled to multiple VPNs or any other flow types by creating multiple instances of the same algorithm. Complexity is proportional to the number of monitors (n) deployed in the network rather than n**2 as proposed by some commercial products.

Patent Application

Two patents are currently applied related to the IP-Aware Correlation algorithm. The first patent relates to the IP-VPN-Aware algorithm and the second patent relates to the Automatic identification of VPN end-points. Both patents are expected to be filed by end of 99.